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NAVY UNDERWATER SOUND REFERENCE LAB ORLANDO FLA
GOODYEAR ELASTOMER PANELS CODE NUMBERS 6265-0/1, 373-3/1, 374-2--ETC(U)
SEP 64

F/6 20/1

UNCLASSIFIED

USRL-CALIBRATION-2215

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UBRL Calibration ~~Supervision~~ - 2215
Project No. 12-3711

UBRL II In MOSI Project - 4 (1)

Measurements on

Numbers

Goodyear Elastomer Panels

Code ~~25~~ G265-0/1, 373-3/1, 374-2/1, 374-3/1,
374-4/1, 375-3/1, 376-3/1, 377-3/1, 4799-0/1 and
T113-0/1

22 September 1964

(12) 9p.

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MOST Project

Department of the Navy, Office of Naval Research
USN UNDERWATER SOUND REFERENCE LABORATORY
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WLP/hs
RP-2711
22 Sep 1964

CALIBRATION REPORT No. 2215

Subj: Goodyear Elastomer Panels Code Nos. G265-0/1, 373-3/1, 374-2/1, 374-3/1, 374-4/1, 375-3/1, 376-3/1, 377-3/1, 4799-0/1, and T113-0/1; measurements on

Ref: (a) Goodyear Aerospace Corp. ltr WS-5053 of 11 Feb 1964 with BUSHIPS endorsement NOber 91066 Ser 688E-119 of 4 Mar 1964
(b) Goodyear Tire and Rubber Co. ltr Ref AQH764-141 of 20 Jul 1964
(c) USRL Calibration Report No. 2131 (RP-2677) of 3 Feb 1964

Encl: (1) Photograph USRL EXR 1-1903-8-64
(2) Tables USRL 1 through 3

1. Seven cord-reinforced and three nonreinforced elastomer panels were evaluated for Goodyear Aerospace Corp. and Goodyear Tire and Rubber Co. as requested and authorized by references (a) and (b), in connection with contract NOber 91066. The panels were 30 inches square, having been cut from the 6-ft-square panels evaluated in January, 1964. The results of that evaluation were reported in reference (c). The purpose of the investigation by Goodyear is to produce reinforced elastomers with high tensile strength but low acoustic transmission loss.

2. The initial test results, reference (c), indicated that additional measurements at frequencies from 20 to 150 kc would be of value. The higher frequency range would permit the use of smaller samples and also make it possible to conduct tests in the USRL anechoic tank at hydrostatic pressures to 1000 psig and at temperatures other than ambient. By endorsement to reference (a), the Bureau of Ships requested that measurements be extended even higher, to the frequency 350 kc, and to low temperatures.

3. Enclosure (1) shows a panel rigged for tests in the anechoic tank. The probe-type hydrophone is placed 34 cm in front of the panel for reflection measurements and is repositioned to 3 cm behind the panel for transmission measurements. The size of the panel limits the lowest frequency for valid data to about 10 kc and to normal-incident sound. Panel descriptions are in table 1 of enclosure (2).

4. The results of the measurements on the reinforced panels are shown in table 2, enclosure (2). At 0 psig, the transmission loss at frequencies of 10 kc and higher depends on prior treatment of the panels. Cleaning the panels with aerosol solution and soaking at shallow depth to eliminate surface-adsorbed air before making acoustic tests was not adequate, as is shown by the large transmission losses in the first part of table 2. Increasing the hydrostatic pressure to 1000 psig decreased the transmission loss to nearly immeasurable values at frequencies below 30 kc. (The notation "<0.5" indicates a value between 0.0 and 0.5 dB that could not be determined accurately because of the nature of the data.)

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The transmission losses following release of hydrostatic pressure were small, variable, nonrepeatable, and generally increased with time to approximately the large initial loss at 0 psig. A special test on panel 374-2/1 revealed that soaking the panel for 15 hours at the hydrostatic pressure 10 psig resulted in transmission losses at 10 psig that were almost identical with the losses measured when the sample was tested at 1000 psig. It was not possible to retest the other panels because of other scheduled work; it is expected that the tests will be made at a later date.

5. The measurements at frequencies above 150 kc were made first, before subsequent tests revealed the effect of hydrostatic pressure. These data, taken with the panels in a 4-ft-deep open tank at room temperature with only 2 feet of water head (1 psig) on the panel, have little significance other than to show the large transmission losses that may exist under certain conditions. The transmission loss at the frequency 350 kc, extrapolated from the measured losses in the region 50 to 150 kc at the pressure 1000 psig, varies from 4 to more than 10 dB for the different panels.

6. The results of measurements on the nonreinforced panels are shown in table 3 of enclosure (2).

7. Under conditions of high transmission (low loss), reflection measurements indicate that only 1 to 2% of the incident sound energy is reflected.

8. This report has been prepared and released to show that nonreinforced elastomers have low transmission losses at low frequencies, but that the conditions of use and/or test affect the transmission loss of reinforced elastomers of the type tested.

W. L. Paine

W. L. PAINE

Copy to:
BUSHIPS (Code 688E)(1)
Goodyear Tire & Rubber Co. (G. A. Steffensen,
Dept. 474-B)(1)
SUPSHIPS (Tech. Libr. Code 249) Groton (1)
USRL (Code 200)(1)

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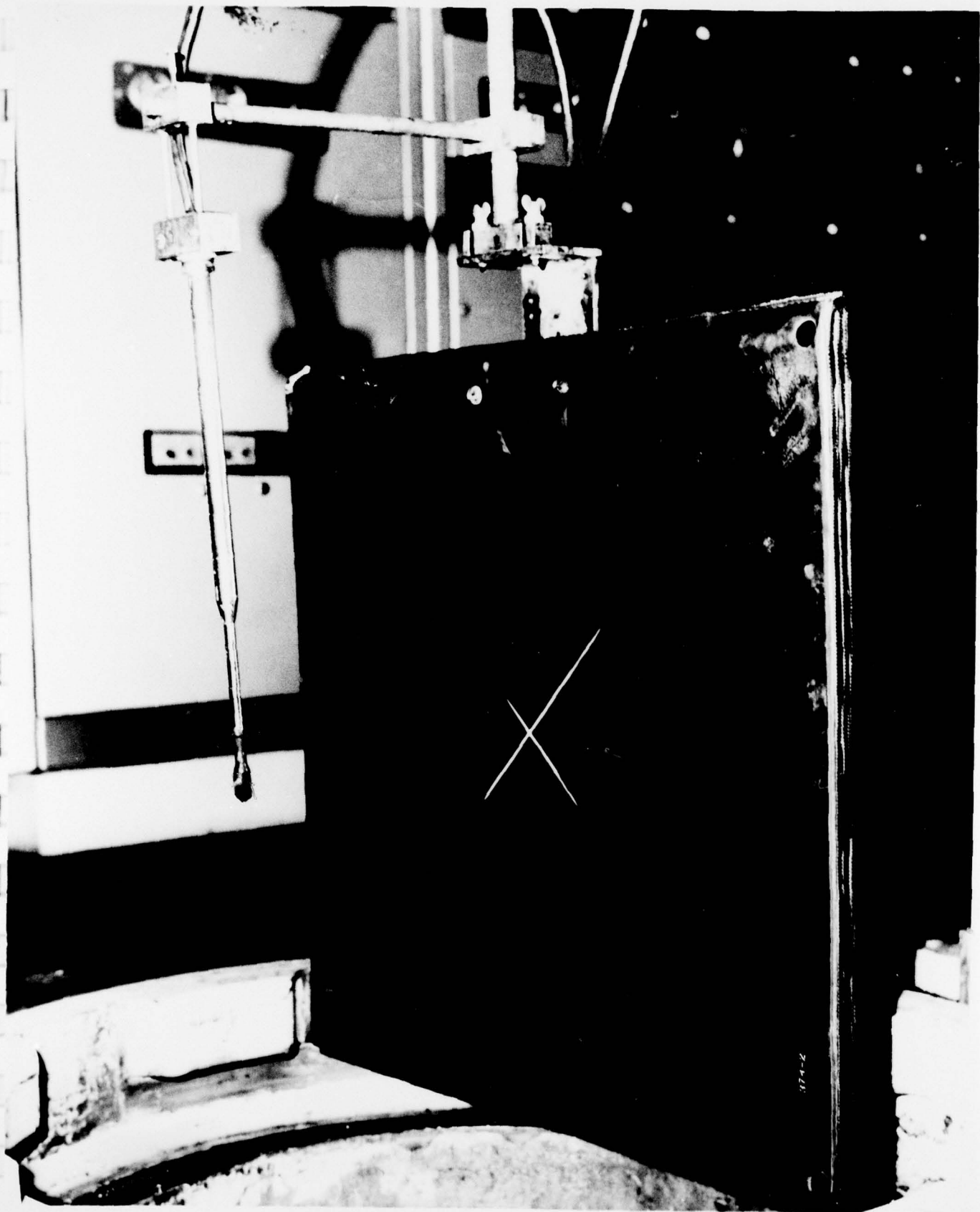


Table 1

PANEL DESCRIPTION*

Goodyear Elastomer Panels
Size: 30 x 30 inches

Panel No.	Thickness (inches)	Reinforcement
G265-0/1	1-3/4	none
373-3/1	1-7/8	cord
374-2/1	1-3/16	cord
374-3/1	1-5/8	cord
374-4/1	2-1/4	cord
375-3/1	1-5/8	cord
376-3/1	1-1/2	cord
377-3/1	1-1/4	cord
4799-0/1	2	none
T113-0/1	2	none

* Type of elastomer and of cord not indicated by manufacturer, except that composition of G265-0/1 was stated to be gum rubber. First eight panels were cut from 5 x 5-foot panels. See reference (c). Last two panels not previously submitted.

USRL Calibration Report No. 2215
Project No. RP-2711

Table 2

TRANSMISSION LOSS
(in decibels)

Normal-Incident Sound

GOODYEAR REINFORCED ELASTOMER PANELS

Temp (°C)	Press (psig)	Freq (kc)	Panel Code No.						
			373-3/1	374-2/1*	374-3/1	374-4/1	375-3/1	376-3/1	377-3/1
25	0	10	0.6	<0.5	<0.5	0.8	<0.5	<0.5	0.7
		15	1.0	<0.5	0.8	1.3	<0.5	<0.5	1.1
		20	1.8	0.6	1.2	1.9	0.8	0.5	1.7
		25	2.2	0.9	1.8	2.2	1.1	0.9	2.0
		30	2.6	1.1	2.0	3.0	1.4	1.0	2.5
		40	3.0	1.8	3.0	4.4	2.3	1.5	3.5
		50	3.4	2.5	3.8	6.0	3.3	2.0	4.8
		75	7.0	4.8	8.2	14.0	6.0	3.8	7.5
		100	10.5	7.0	11.5	16.0	9.5	5.2	12.5
		125	13.5	9.2	14.5	17.0	13.0	7.5	25.0
		150	15.0	12.0	17.0	22.0	17.0	11.0	29.0
		200	>30.0	18.0	>30.0	>30.0	>30.0	18.0	>30.0
		250	>30.0	27.0	>30.0	>30.0	>30.0	25.0	>30.0
		300	>30.0	29.0	>30.0	>30.0	>30.0	27.0	>30.0
		350	>30.0	>30.0	>30.0	>30.0	>30.0	>30.0	>30.0
	1000	10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
		15	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
		20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
		25	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
		30	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
		40	0.7	0.6	<0.5	<0.5	0.7	0.6	0.6
		50	0.9	0.9	<0.5	0.7	1.1	0.8	0.9
		75	1.3	1.0	0.9	0.9	2.1	1.2	1.0
		100	1.9	1.5	1.2	1.7	3.2	1.6	1.6
		125	2.2	2.0	2.2	3.0	5.0	2.6	2.0
		150**	2.8	3.0	4.0	4.0	6.2	3.2	2.4
4	0	10	0.8	<0.5	<0.5	<0.5	0.5	<0.5	1.0
		15	1.2	0.5	1.0	1.1	1.0	1.1	1.3
		20	1.7	0.7	1.8	1.7	1.6	1.2	1.8
		25	2.3	0.7	2.0	2.2	2.1	1.5	2.2
		30	2.5	0.7	2.1	2.4	2.4	1.7	2.5

(continued)

Table 2 (continued)

TRANSMISSION LOSS
(in decibels)

Normal-Incident Sound

GOODYEAR REINFORCED ELASTOMER PANELS

Temp (°C)	Press (psig)	Freq (kc)	Panel Code No.							
			373-3/1	374-2/1*	374-3/1	374-4/1	375-3/1	376-3/1	377-3/1	
4	0	40	3.1	0.8	2.7	3.2	2.6	1.9	3.0	
		50	3.7	0.8	3.8	4.4	3.0	2.2	3.5	
		75	7.7	1.2	8.0	7.7	7.0	4.2	7.3	
		100	11.0	1.3	12.0	12.0	11.0	5.3	11.0	
		125	14.0	2.5	18.0	18.0	13.0	7.8	16.0	
		150	15.0	3.6	20.0	19.0	17.0	11.0	23.0	
4	1000	10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
		15	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	
		20	0.5	<0.5	<0.5	0.5	0.8	<0.5	0.9	
		25	0.9	<0.5	0.5	0.7	1.2	<0.5	1.0	
		30	1.0	<0.5	0.7	0.7	1.2	0.5	1.0	
			40	1.1	<0.5	0.7	0.8	1.2	0.6	1.1
		50	1.2	0.9	0.7	0.8	1.3	0.8	1.1	
		75	1.4	1.0	1.3	1.4	2.9	1.4	1.3	
		100	1.6	1.2	2.2	2.0	4.2	1.5	1.6	
		125	2.3	2.2	3.0	3.5	5.4	1.7	2.1	
			150***	3.2	3.3	4.7	5.5	7.2	3.5	3.3

* Pressure maintained at 10 psig for 15 hours while being cooled from 25 to 4°C before measurement at 0 psig

** Not measured above 150 kc at pressures other than 0 psig

*** Not measured above 150 kc at temperatures other than 25°C

Table 3

TRANSMISSION LOSS
(in decibels)

Normal-Incident Sound

GOODYEAR NONREINFORCED ELASTOMER PANELS

Temp (°C)	Press (psig)	Freq (kc)	Panel Code No.		
			G265-0/1	4799-0/1	T113-0/1
25	0	10	<0.5	<0.5	<0.5
		15	<0.5	<0.5	<0.5
		20	<0.5	<0.5	<0.5
		25	<0.5	<0.5	<0.5
		30	<0.5	<0.5	<0.5
		40	<0.5	<0.5	<0.5
		50	<0.5	<0.5	0.5
		75	<0.5	<0.5	0.6
		100	0.5	0.5	0.7
		125	0.7	0.5	0.8
		150	0.9	0.6	0.9
		200	1.1	0.6	1.0
		250	1.3	0.8	1.5
		300	1.5	1.0	2.0
		350	2.0	1.2	2.5
25	1000	10 ↓ 150*	All values <0.5		
4	0	10	<0.5	<0.5	<0.5
		15	<0.5	<0.5	<0.5
		20	<0.5	<0.5	<0.5
		25	<0.5	<0.5	1.0
		30	<0.5	<0.5	1.0
		40	<0.5	<0.5	1.0
		50	<0.5	<0.5	1.0
		75	<0.5	<0.5	1.3
		100	0.6	<0.5	1.7
		125	0.7	<0.5	1.8
		150	0.8	0.8	2.0

(continued)

Table 3 (continued)

TRANSMISSION LOSS
(in decibels)

Normal-Incident Sound

GOODYEAR NONREINFORCED ELASTOMER PANELS

Temp (°C)	Press (psig)	Freq (kc)	Panel Code No.		
			G265-0/1	4799-0/1	T113-0/1
4	1000	10	<0.5	<0.5	<0.5
		15	<0.5	<0.5	<0.5
		20	<0.5	<0.5	0.6
		25	<0.5	<0.5	1.0
		30	<0.5	<0.5	1.0
		40	<0.5	<0.5	1.0
		50	<0.5	<0.5	1.1
		75	<0.5	<0.5	1.1
		100	<0.5	<0.5	1.2
		125	<0.5	<0.5	1.2
		150**	<0.5	<0.5	2.0

* Not measured above 150 kc at pressures other than 0 psig

** Not measured above 150 kc at temperatures other than 25°C